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Within the broad context of DOD acquisition reform, this paper evaluates a variety of organizational and management alternatives in light of the underlying principle of a Third Wave civilization - information exploitation. It first demonstrates that organizational structure depends upon a unique combination of system and organization characteristics. After highlighting the basics of complexity theory, the paper relates the key tenets of self-organization within complexity theory to current management initiatives - teaming, process orientation, system thinking, and strategic planning. It concludes by recommending organizational and management guidance based on the principles of complexity theory and proposes several initiatives that can excite and accelerate reform within the DOD acquisition.

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THIRD WAVE MILITARY ACQUISITION:

ORGANIZATIONAL & MANAGEMENT CONSIDERATIONS FOR A COMPLEX SYSTEM

by

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Lieutenant Colonel, United States Air Force

A paper submitted to the Director, Advanced Research Department as an Advanced Research Project in partial satisfaction of the requirements of the Naval War College for the degree of Master of Arts in National Security and Strategic Studies.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College, the Department of the Navy, or the Department of the Air Force.

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16 June 1995

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EXECUTIVE SUMMARY

Within the broad context of acquisition reform, this paper evaluates a variety of organizational and management alternatives in light of the underlying principle of a Third Wave civilization--information exploitation. Although the military acquisition system has produced the world's premier weapon system inventory, its cost, schedule, and technological inefficiencies jeopardize future U.S. military superiority. THERE HAS TO BE A BETTER WAY!

No single, ideal organizational structure was found which can improve the exploitation of information within the military acquisition system. Rather, organizational structure was logically observed to depend upon a unique combination of system and organization characteristics: product, process, timing, resources, culture, geography, and personality. An organization constantly changes to optimize its existence within the surrounding environment. Most important, though, an organization's process outweighs the impact of any other characteristic. FORM FOLLOWS FUNCTION.

By way of additional research, the relatively new science/theory of complexity shows surprising applicability to evolutionary organizational and management trends. Armed with a basic understanding of complexity theory, one concludes that from a complex adaptive system, like DoD acquisition, there emerges "order for free." The system naturally evolves toward the "edge of chaos," the point of maximum capacity for information processing, if each system follows two prime rules:

(1) maximize mutual information (necessary and relevant);

(2) minimize local energy loss/cost (maximizing local productivity).

It does this through collective adaptation toward selfish ends which produces maximum average productivity, each participant in context with the others. The system as a whole emphasizes searching for THE RIGHT JOB rather than doing the current job right.

Several current organizational and management themes have tended to better exploit information and increase the probability of success. They include teaming, process orientation, system thinking, and strategic planning. Each demonstrates evolutionary characteristics in light of complexity theory and exist as a possible alternative toward better organization and management solutions.

Based on complexity theory and supported by numerous examples in private sector business, this research proposes the following guidance:

- Recognize that DoD's acquisition system will self-organize toward a better organizational solution at each level of management.

- Create an acquisition system environment which promotes and accelerates this evolutionary process toward optimization.

  -- Eliminate or relax negative system constraints within acceptable risk.

  -- Establish dramatic positive constraints which will stimulate creativity through increased information processing.

The constraints on the system are key to the evolutionary process. The mitigation of negative constraints, an action counter to the historical trend in acquisition, will expand the number of possible system solutions. But first and foremost, DoD must establish dramatic positive constraints or "stretch goals." The following are possible examples:

Cost. In ten years, reduce government acquisition-related operating costs by 50 percent.

Schedule. Reduce acquisition cycle time 50 percent within the next ten years.

Performance. Increase reliability of all products by 100 percent within ten years.

These actions alone will demand creativity, arising from a massive processing of information within the system and with other systems.

Lacking from this research is a solution to incentives within DoD. Profit tangibly motivates the private sector. Survival motivates the warfighter.

Incentives in acquisition, however, are not as hard-hitting as profit or survival. It is highly recommended that future research efforts tackle this issue, a complementary and necessary key to success.

The DoD acquisition system must fully transition itself into the Third Wave civilization. With information exploitation as the key, the principles of complexity theory describe the door through which the system should pass. Organizational structure, albeit a factor, is not the answer. Rather, all acquisition participants--OSD, warfighter, contractor, service staffs, and the DoD acquisition community--must create an appropriate system environment which stimulates the accelerated evolution of a better way of doing business. Through the maximum sharing of mutually beneficial information and the "selfish" maximization of local productivity, A BETTER SYSTEM WILL EMERGE! And "stretch goals" will provide the strongest impetus toward that CREATIVITY and ACTION. Now is the time for the DoD acquisition system to FIND THE RIGHT JOB!

CONTENTS

CHAPTER 1

INTRODUCTION

THE PARADOX

The United States military acquisition system paradoxically exemplifies both the best and the worst in management systems. On the one hand, it has produced the world's premier weapon system inventory--an arsenal second to none in overall quantity and quality. And yet, that same system continues to receive criticism from both private and government sectors as a highly inefficient and ineffective process. As Defense Secretary William J. Perry stated in "Acquisition Reform: A Mandate for Change":

> . . . DoD [Department of Defense] has been able to develop and acquire the best weapons and support systems in the world. DoD and contractor personnel accomplished this feat not because of the system, but in spite of it. And they did so at a price--both in terms of the sheer expense to the Nation and eroded public confidence in the DoD acquisition system. It is a price the Nation can no longer afford to pay.[1]

Put succinctly, weapon systems cost too much, take too long to reach operational units, and many times reflect outdated technologies once they get to the field. A recent study of ten defense contractors sponsored by the Department of Defense (DoD) estimates that doing business with the government costs a company 18 percent more than in the private sector.[2] "This study measured the

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1 William J. Perry, "Acquisition Reform: A Mandate for Change," *Defense Issues*, February 1994, pp. 1-5.

2 Paul G. Kaminski, U.S. Under Secretary of Defense for Acquisition and Technology, to Peter Levine, Counsel in U.S. Congress, Senate. Letter, 7 January 1995.

cost differential imposed by government-unique practices and tied [it] to specific regulatory and statutory provisions."[3] The government absorbs this additional expense by paying a higher price for each product. Some companies even choose not to do business with the government because of the excessive bureaucratic requirements. This, on occasion, has prevented DoD from either gaining access to specific products or acquiring quality products for less cost.

These same bureaucratic requirements inordinately extend the development and procurement time of many items. Commercial technologies have a design cycle of approximately 3-4 years compared with those in DoD at 8-10 years.[4] Major weapon systems like the F-22 take over twenty years from initial concept to operational fielding. In the meantime, mission requirements change, thereby changing system requirements. This in turn causes another delay for redesign/redevelopment and the cost of the weapon system climbs tremendously as its acquisition program "slips to the right."

Finally, many weapon systems reach operational units technologically obsolete, outdated by faster-paced, private sector technology development.[5] As the Deputy Under Secretary of Defense for Acquisition Reform, Mrs. Colleen Preston, related to the Committee on Government Reform and Oversight in the House of Representatives:

> . . . information systems technology turns over on an average of 18 months, yet, not using small purchase procedures, but a simple Invitation for Bids, takes us an average of 90 days. A negotiated procurement, takes an average of 210 days, and a complex services contract to support one of our program management offices takes an average of 300 days. We can't even get on contract before technology is obsolete.[6]

Likewise, technological innovations within the business community have quickly outpaced breakthroughs like those in nuclear and stealth technologies, which

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3 Ibid.

4 Perry, "Acquisition Reform," p. 3.

5 Ibid.

6 Colleen A. Preston, Deputy Under Secretary of Defense (Acquisition Reform), "Statement on Acquisition Reform," before the Committee on Government Reform and Oversight, U.S. House of Representatives, Washington, D.C., 21 February 1995.

past military acquisition programs have produced. Andrew Krepinevich states:

> The information-led military-technological revolution is not being driven . . . by developments in a few top secret U.S. laboratories. Rather, it is highly diffused, occurring as much, if not more, in the commercial sector as in the defense sector, and throughout the advanced industrial world.[7]

These inefficiencies in the acquisition system jeopardize future U.S. military superiority and consequently the Nation's security! With a shrinking budget, excessive costs limit the number and variety of weapon systems the military can afford to field. Extended procurement time fails to satisfy mission needs while further increasing cost and oftentimes providing the warfighter with outdated technologies. Although this same acquisition system has produced an unequaled arsenal, THERE HAS TO BE A BETTER WAY!

This paper evaluates a variety of organizational and management alternatives in the broad context of acquisition reform. Using the generally-held assumption that U.S. society has transitioned into the Information Age, it examines different system frameworks in light of the underlying principle of a Third Wave civilization: that the exploitation of information largely determines success in nearly every endeavor.[8] Many private sector businesses have proven successful in this regard and provide numerous examples for study.

The major issue of this paper addresses the impact of organizational structure on the exploitation of information within a system. No single ideal structure was found appropriate to the military's acquisition system. Rather, organizational structure was logically observed to depend upon a unique combination of system and organizational characteristics.

Ostensibly unrelated, the relatively new science/theory of complexity shows surprising applicability to evolutionary organizational and management trends. Not only does it support the conclusion reached regarding organizational

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7 Andrew F. Krepinevich, Jr., "Keeping Pace with the Military-Technological Revolution," *Science & Technology*, Summer 1994, p. 27.

8 Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (New York: Little, Brown and Co., 1993).

structure, but it also lends credibility to the rising organizational and management initiatives currently pursued within the private sector and spilling over into the military acquisition system. Several of these initiatives make significant strides toward the more effective and efficient use of information. Using examples from both private sector and military Third Wave "champions," the paper illustrates the correlation between these initiatives and complexity theory.

This paper ultimately provides a unique unification of ideas inherent to theories in organization, management, complexity and information and relates it to the DoD acquisition system. It concludes by recommending organizational and management guidance based on the principles of complexity theory. It also proposes several initiatives that can excite and accelerate reform within the military acquisition system. By incorporating them, the military acquisition system can hopefully progress toward better efficiency and effectiveness in satisfying the warfighters' requirements.

WHAT IS THE THIRD WAVE CIVILIZATION?

The United States has evolved into a Third Wave civilization. In Alvin and Heidi Tofflers' thought-provoking and forward-looking book, *War and Anti-War*, they describe three distinct waves of civilization. The First Wave evolved from the agricultural revolution and involved an agrarian-based economy. The industrial revolution catalyzed Second Wave civilizations with economies founded on the principle of mass production. Today, the Tofflers suggest, we find ourselves in the midst of a Third Wave civilization, one which employs knowledge as the basis of its economy.

Dominance in any of the three waves depends upon the ability to exploit its very foundation--agriculture, industry, or information. If today's more advanced civilizations spring from a knowledge-based foundation, then how it creates and exploits knowledge will determine its ultimate success or failure in the world arena.[9] Stated another way, **in a Third Wave civilization/Information Age, the effective and efficient *exploitation of information* is a critical element of success!** This paper addresses how the military acquisition system might embrace the underlying principle of the Third Wave civilization and thereby posture itself more favorably to satisfy the demands of the warfighting function.

Similar to the U.S. military acquisition system situation described earlier, much of private sector business found itself mired in a Second Wave civilization amidst the accelerated pace of the Third Wave. The commercial sector, however, has seized the initiative and taken the lead as a matter of survival. Some companies, even huge corporations like Ford, faced tremendous losses because they ignored the evolution toward the Third Wave. They rested on the success of their past, mass production, and quickly found themselves the victims of information-based organizations. Not until they joined the revolution did their lot improve.[10]

Embodied in the quality culture, new management approaches helped the civil sector capitalize on knowledge-driven ideas that skyrocketed companies to unfathomable heights. Some, like CNN and MCI, as one might logically conclude, were successful because they engaged directly in the information business.[11] The wholly successful were those who harnessed the power of knowledge within their business. Ford's Team Taurus, following the vision of "Quality is Job 1,"

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9 Toffler , p. 64.

10 Mary Walton, *The Deming Management Method.* (New York: Putnam Publishing Group, 1986), p. 139.

11 Tom Peters, *Liberation Management: Necessary Disorganization for the Nanosecond Nineties.* (New York: Alfred Al Knopf, 1992), pp. 41, 306.

created new knowledge pathways and helped recapture the company's place in the market.[12]

The military acquisition system more closely emulates private sector business than any other organization or system within DoD. It delivers a product, the weapon system, to a customer, the warfighter, based on a unique demand or mission requirement. Defense contractors, as suppliers, develop the product while the acquisition system acts as an internal purchasing agent for the military. Although differences exist, the military acquisition system has operated, and will continue to operate, much like a business in the private sector. Since the military acquisition system, in essence, exists as a business, it can directly transfer the lessons learned from the private sector to improve its own posture for the future.

INFORMATION EXPLOITATION

The underlying objective of any Third Wave acquisition system strategy should be to capitalize on knowledge. It must posture the organization to promote, encourage, and even demand the continual flow of information. A focused and disciplined sharing of mutually beneficial information throughout the acquisition system remains the key. Communication, therefore, becomes a pillar of the system and a significant characteristic would be enhanced information connectivity throughout the system.

Most people consider information as data relating in a variety of ways to a particular subject or activity. Among innumerable sources, information exists within the minds and skills of people, within the processes of systems, and even within sources outside the system. When one understands information, one enhances the power or ability to act relative to the system. In other words,

[12] Walton, pp. 139-144.

information understood provides a better foundation upon which to make a decision toward some action. Exploitation of information, therefore, means the act of gaining an advantage based on this information. In order to exploit information, one must gain access to it (communication), analyze and comprehend it, and decide how to act upon it.

Information within the military acquisition system exists in two forms. Innovations or new ideas such as technologies provide the impetus for new weapon system acquisition or current weapon/support system modernization upgrades. This type of information keeps the military arsenal state-of-the-art, on the leading edge. The second form, management information, provides process-related information to decision makers throughout the entire acquisition system. These can be categorized into familiar cost, schedule, and performance groupings for the various processes and subsystems within each program. This paper will address managerial information as including all information since innovation essentially affects system performance.

THESIS

In examining how some private sector companies attacked the issue of information exploitation, one notices that many used organizational structure as a key approach. This appeared logical in that structure dictates formal interfaces/interactions and these therefore define how information flows throughout the organization. As Hammer and Champy state, ". . . the organizational structure establishes the lines of communication within the organization and determines the decision-making hierarchy."[13]

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13 Michael Hammer and James Champy, *Reengineering the Corporation: A Manifesto for Business Revolution* (New York: HarperCollins Publishing, Inc., 1993), p. 78.

Tom Peters, in his book, *Liberation Management: Necessary Disorganization for the Nanosecond Nineties*, while documenting numerous examples of "organizational restructuring," emphasizes the importance of structure on information within the organization. "Organizations are pure information processing machines--nothing less, nothing more: Organizational structures, including hierarchies, capture, massage, and channel information--period."[14] He goes on to state: "Information is organization. Change the organization, and you change the information flow."[15]

Other approaches are possible in developing a Third Wave system aimed at increasing the flow and exploitation of knowledge through better communication. Yet, since communication is ultimately the interaction between people, the way we organize mandates most directly how we communicate. Organizational structure, therefore, provides the critical and most value-added framework within which a knowledge-based strategy must function. And since organizational structure seems to greatly influence the exploitation of information within the private sector, the thesis of this paper evolved to the following:

> THERE EXISTS AN IDEAL ORGANIZATIONAL STRUCTURE WHICH CAN IMPROVE THE EXPLOITATION OF INFORMATION WITHIN THE MILITARY ACQUISITION SYSTEM.

14 Peters, p. 110.

15 Ibid., p. 181.

CHAPTER 2

THESIS ANALYSIS

ACQUISITION SYSTEM MANAGEMENT

Before delving into the analysis of the original thesis, one must first understand the perspective of the military acquisition system used in this paper. From a macro-level perspective, it has three key participants: the defense contractor; the DoD acquisition community; and the warfighter. The contractor predominantly designs and develops the weapon system. The acquisition community--the primary, but not sole, focus of this paper--manages the weapon system program from "birth to death." And finally, the warfighter employs the weapon system.

To borrow a warfighting analogy, three levels of management exist within the DoD acquisition system--strategic, operational, and tactical. The Office of Secretary of Defense (OSD), the service acquisition staffs, and the Program Executive Officer (PEO) comprise the strategic level. They establish policy and strategic program objectives. They exercise oversight to ensure program execution meets policy objectives all within current laws and regulations. The operational level of management resides with the System Program Director (SPD). This is the focal point of all acquisition management. The SPD translates strategic policy and objectives into operational objectives unique to the particular weapon

system program. The SPD likewise oversees the tactical execution of these objectives and provides feedback to the strategic level. The tactical level of management includes everyone else within the acquisition community--program office personnel, depot personnel and materiel and acquisition command staffs. These organizations translate operational objectives into tactical plans and subsequently execute them.

One should recognize that each level of management also has its own strategic, operational, and tactical objectives and plans. As in the warfighting analogy, all management policies and objectives are designed to flow from the top in a coordinated fashion. We usually think of these terms--strategic, operational, and tactical--as uniquely associated with military operations. Yet private sector companies use these exact same terms in describing their levels of management, objectives, and plans.[16] This further highlights how private sector organizational conduct can directly correlate to the military acquisition system.

METHODOLOGY

Two primary approaches served as research sources in evaluating the proposed thesis--literature review and interviews. A broad review of published material germane to this subject provided a wealth of data. Classical textbooks first outlined basic characteristics of organizational theory. Two relatively current and well-respected books regarding modern-day management approaches explained the transition of classical organizational/management theory into the management initiatives of today. *Reengineering the Corporation* by Hammer and Champy[17] and *The Fifth Discipline* by Senge[18] both described,

16 Interview, with personnel in Motorola Lighting, Inc., Chicago, IL, 19 April 1995.

17 Hammer.

18 Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday, 1990).

with examples, how businesses must conduct themselves in order to survive. Tom Peters, in his book *Liberation Management*[19] described a myriad of management approaches through an extensive compilation of case studies. Recent articles from organizational and management periodicals and journals complemented the aforementioned theoretical and case study information.

Personal interviews provided the most valuable insight into the issues impacting the subject of this paper:

- The OSD Acquisition Reform Office presented a strategic perspective of the situation. (A later section of this paper addresses the on-going initiatives of this office relating to acquisition reform.)

- The Defense Systems Management College (DSMC) at Fort Belvoir, VA, the clearinghouse of all aspects of DoD acquisition management, offered both an historical and realistic assessment of reform initiatives.

- From the warfighters' perspective, personnel from the 1st Fighter Wing and Air Combat Command's Fighter Requirements Office at Langley AFB, VA, discussed their unique concerns with the acquisition system's status and future.

- The F-15 System Program Office (SPO) at Wright-Patterson AFB, OH and its counterpart program office at McDonnell-Douglas Corporation in St. Louis, MO, provided both a government and contractor assessment within a single weapon system program from the operational and tactical levels of management.

- The F-22 SPO described some of its unique management initiatives in acquiring a new weapon system, while Wright Laboratory personnel discussed technology and its impact on both the military acquisition system and the business community.

These interviews spanned the vertical layers of management within the DoD acquisition community, from the strategic to the tactical levels. They also examined the horizontal spectrum of participants from defense contractor to warfighter. From the private sector perspective, Motorola Lighting, Inc. of

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[19] Peters.

Chicago, IL, a company within Motorola Corporation, described its unique organizational and management efforts to achieve survival and success.

Time and funding limited the extent of this direct research venue. Although most of the effort focused on the organization and management pertaining to Air Force aircraft systems, the correlation to the other services' acquisition systems suffices primarily due to the macro-level perspective of this paper. In a similar vein, contact was made with only one private sector business. For the level of this research, however, the numerous case studies reviewed in the literature sources proved sufficient.

ORGANIZATIONAL CONSTRUCTS

"Organization structure is the manner in which the subunits (components) of an organization are designed and interrelated."[20] It dictates who does what and indirectly how they interface. Most people think of an organizational chart--a simple graphic of "who reports to whom"--when they hear the words organizational structure. And yet, that chart implies more than mere supervisory delineation. It more importantly constructs the formal flow of information throughout the unit. It does not depict, however, the all important informal communication within a unit.

Organizational structures appear to fit into one of two groups--bureaucratic or non-bureaucratic. A bureaucracy, despite its popular meaning, ". . . is a rational, systematic, and precise form of organization in which rules, regulations, and techniques of control are defined clearly."[21] A non-bureaucratic structure refers to an organization with "decentralized decision making, considerable employee participation, and extensive use of temporary

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[20] Andrew J. DuBrin, R. Duane Ireland and J. Clifton Williams, *Management and Organization* (Cincinnati, OH: South-Western Publishing Company, 1989), p. 205.

[21] Ibid., p. 208.

groups."[22] Bureaucratic structures which specialize work and fragment processes sometimes stifle innovation and creativity within an organization. For instance, an idea must pass through a hierarchy of filters with only one "no" to stop it. Organizational designers, however, view this as a safeguard against unwarranted risk.[23] On the surface, then, it appears that a non-bureaucratic structural form enhances information flow while a bureaucratic form impedes it.

Departmentalization, another aspect of organizational structure, serves to logically organize work into manageable subunits. The following paragraphs discuss major departmentalization forms and how they impact information exploitation.

Functional Departmentalization--organized by the inherent tasks of the unit. In a program office, one may find divisions such as contracting, engineering, manufacturing, and test, among others. Commonly referred to as a "stovepipe" organization, information flows (formally) vertically up to a department manager, transfers horizontally to another department manager, and then vertically down to the intended worker. As described, this structure, a pure bureaucratic hierarchy, seems to detract from efficient communication. And yet, many organizations overcome this limitation through informal communication networks and sometimes more flexible, formal communication processes.

Product Departmentalization--organized according to the products or services it provides. Program offices are product organizations within the military acquisition system, responsible for a single weapon system, with all required activities self-contained. This structure appears to promote information processing relative to the ultimate mission, in this case, the acquisition of a weapon system. However, the organizational structure within program offices has traditionally remained functional, a possible degradation to communication. Remember too, that horizontal communication across the acquisition system, to

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[22] Ibid., p. 219

[23] Hammer, p.28.

contractor and warfighter, is not necessarily improved. The move toward Integrated Product Teams (cross-functional product organizations) within weapon system programs and OSD[24] takes this concept to a new level of complexity (to be discussed more thoroughly later).

Customer Departmentalization--organized based on customer needs. This structure focuses on the customer and how the organization interfaces with the prime driver of the unit's reason for existence. During DESERT STORM, as an example, some program offices deployed Product Support Teams (PSTs) with operational units directly into the combat theater in order to improve communication, real time, with the warfighter, the customer.[25] The teams included contractors, thereby establishing a complete horizontal interface with the warfighter. This concept definitely enhances horizontal communication within the system, but does nothing for internal organizational communication nor vertical system communication flow.

Territorial Departmentalization--organized according to the geographic area served. One normally finds these at higher echelons within an organization, depending on the size and scope of its mission and the unique demands of geography. Since the military has a global mission, the regional unified commands display this concept thoroughly. The similar topographical and interrelated political characteristics of one area of the globe are addressed together. Regional divisions within national (or international) companies again highlight this structure, one based upon the particular demographics and legal constraints impacting the organization's mission. Virtually self-contained, these autonomous organizations process information much like a product structure, yet on a different scale. Again, the internal structure of the organization may dictate a different flow of information.

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24 U.S. Department of Defense, Office of the Secretary, "Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition." Draft memorandum undated.

25 Joanne S. Schoonover, "Accelerated Air Force Acquisition Process: Lessons Learned from Desert Storm" (Maxwell Air Force Base, AL: Air University Press, August 1994), pp.54-55.

Process Departmentalization--organized according to the inherent processes necessary to deliver a product or service to the customer. Depending on the level of management, this structure can afford good communication within the organization. "Typing pools" within a unit serve as an example. Yet they may be fragmented from the remainder of the other processes and therefore stifle information processing.

Matrix Organization--the overlay of a product structure on a functional structure. This hybrid design attempts to exploit the advantages of both basic structural constructs. Organizational complexity increases while also increasing the information transferred both horizontally and vertically. The fact that an individual reports to two different organizations while performing the same job, however, contributes to his/her state of confusion. Communication can thus be impeded by "loyalties."

System 4 Organization--a non-bureaucratic structure which emphasizes open, supportive leadership, and participative decision-making and goal setting.[26] Readily adaptable to change, this structure sees the unit manager as an integral part of his/her work unit, yet serving the coordinating function to the next higher level. They are "linking pins" in the organizational framework.[27] This structural concept depends upon and promotes information processing within work units and attempts to maintain this same characteristic vertically within the system. It relies heavily on a fluid managerial philosophy.

Flat Organization--non-bureaucratic structure with few layers of management. Information flows more freely with fewer managers to review decisions at lower levels. Likewise, with a shorter management chain of command, individuals perceive less distinction in authority levels and naturally become more communicative.

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[26] Dubrin, p. 219.

[27] Ibid., p. 221.

THESIS DISPROVED

Research concluded that organizational structure depends on a unique combination of system characteristics: product, process, timing, resources, culture, geography, and personality. These interdependent characteristics define the environment within which the organization must design its structure in order to more optimally exploit system information. The results of research, therefore, contradicted the thesis. Simply stated, ***no single ideal organizational structure was found which can improve the exploitation of information within the military acquisition system.*** As one might expect, when in search of an ideal of any type, one most probably will never attain that goal. "The design of an effective organizational structure cannot be guided by a 'one best way' theory."[28] No two acquisition organizational structures should look identical. The remainder of this chapter discusses these characteristics and how they impact an organization's structure.

Product (What/Why). An organization must first determine its product--WHAT it delivers to the customer (in management vernacular). In operational phraseology, WHAT is the unit's mission? WHY does the unit exist? Hardware-producing organizations, like most program offices, may choose one structure while service-oriented organizations like OSD may choose another.

Process, Process, Process (HOW). HOW an organization intends to develop/supply/deliver its unique product strongly influences the design of its structure. Said another way--FORM FOLLOWS FUNCTION! Trying to force a process to fit a structure can meet with disastrous results. On the other hand, a unit can achieve better efficiency if its structure becomes a process by-product. "Define a reengineering effort [a concept discussed later] in terms of an organizational unit, and the effort is doomed. Once a real work process is

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28 James C. Gibson, John M. Ivancevich and James H. Donnelly, Jr., *Organizations: Behavior, Structure, Processes*, 6th ed., (Homewood, IL: Business Publications, Inc., 1988), p. 526.

reengineered, the shape of the organization required to perform the work will become apparent."[29] In other words, the basic activities an organization must accomplish to develop its product, the job definitions and interactions of its component parts, will naturally determine its organizational structure. That design will enhance the process owing to its unique fit. Hallmark, for instance, regrouped its workers into new product process teams. Previously separated by functional departments, floors, and buildings, they found increased creativity through enhanced communication. Products reached the market eight months ahead of schedule.[30]

Timing (WHEN). An organization's structure depends also on the life cycle of the product. Within the context of the current acquisition system, program offices early in a weapon system's life cycle, say pre-Milestone I, may organize differently than several years hence when that same program passes Milestone II. Although the ultimate mission of the unit remains the same, the time-dependent products change dictating variations in the unit's processes and therefore its structure. For instance, the F-22 System Program Office (SPO) will most likely restructure itself now that they have passed a major developmental event--Critical Design Review.[31]

Resources (WITH WHAT). If an organization possesses unlimited resources, primarily manpower, funding, and time, the unit could implement a wide variety of processes which may accomplish the mission. Reality, however, mandates leaner operations and therefore limits the alternatives. The McDonnell-Douglas F-15 program office restructured itself along Integrated Product Team (IPT) lines [this concept is described thoroughly later in the paper] to match its counterpart government organization. When external constraints forced a

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29 Hammer, p. 40.

30 Ibid., p. 167.

31 Interview with Colonel William J. Jabour, F-22 System Program Office, Aeronautical System Center, Wright-Patterson Air Force Base, OH, 18 April 1995.

manpower reduction, they were unable to efficiently support the IPT concept and again reorganized toward a matrix-like organization.[32]

Culture (HISTORY). The cultural mind set of an organization and its personnel oftentimes constrain the alternatives of a unit's design. The "dinosaurs," the highly structured people entrenched in the ways of the past present tremendous obstacles toward any refinement of a unit's traditional design. In some respects, units may have honed a theoretically inefficient structure into a smooth-running machine. To change may seriously degrade that efficiency. One might say that the separate services have honed their unique contributions to the Nation's military capabilities and the movement toward joint operations tends to destroy that capability. (This example only demonstrates an impediment to change and does not negate the value of a change toward joint operations.) And yet, stagnation may portend just as much danger as any change.

From another perspective, observations made during research recognized the inadvisability of **mandating** an organizational change. Good management practice requires buy-in by a large majority of the key participants. For example, the F-15 SPO Director, recognizing the value of a structural reorganization of the unit's original design, delayed attempts toward implementation until all mid-level managers agreed, as a group, that the restructuring was the right action to pursue. This group, the key implementers of any restructuring, were initially reticent to the proposal based on their past experience. Once "on board," the transformation progressed smoothly.[33] On the other hand, there may also come a time when a manager must mandate change, when the need for change is obvious and buy-in would be untimely or not forthcoming. Although not an ideal situation, the manager must direct the change knowing full well that he/she is taking a calculated risk in order to save the organization.

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32 Interview with personnel in F-15 Program Office, McDonnel-Douglas Corporation, St. Louis, MO, 17 April 1995.

33 Interview with Colonel James DeStout, Director, F-15 System Program Office, Aeronautical System Center, Wright-Patterson Air Force Base, OH, 18 April 1995.

Geography (WHERE). WHERE various members of an organization reside/locate also strongly influences its structure. A collocated unit enjoys advantages over geographically separated organizations. Information transfer and control requires different levels of effort when hampered by distance and/or time. The positioning of many weapon systems throughout the globe creates a unique communication problem for the military acquisition system. The F-15 program, through the use of innovative information technology systems, available within the commercial market, has created EAGLE NET. This disciplined means of information processing hopes to network every entity within the global F-15 system--warfighter, contractor, program office, depot, laboratory, test center, OSD, and service staffs.[34] The increased yet disciplined information flow should greatly accelerate acquisition system responsiveness to all participants' needs.

Personality (WHO). People comprise organizations. Each person, possessing a unique personality, interacts with those around him/her again in a unique way. These interrelationships oftentimes dictate (sometimes informally) the processes executed/conducted by the unit. Extreme personality types, both strong and weak, can greatly influence an organization's mission accomplishment, whether in a leadership position or not. Organizational structure can therefore either promote a positive personality or hinder/control a negative personality (or vice versa).

Summary. As one might intuitively conclude, and research verified, a unique combination of organizational characteristics defines the environment upon which its structure depends. One individual described his organization as an "amoeba," constantly changing form to optimize its existence within the surrounding environment.[35] Its mission remains the same but it adjusts to optimize its performance within the given constraints. Most importantly, though,

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[34] Ibid.

[35] Interview, McDonnel-Douglas Corporation.

an organization's process, how it accomplishes its mission, outweighs the impact of any other characteristic. FORM FOLLOWS FUNCTION! Yet, at the same time, they are all interdependent.

The underlying dilemma still remains, however--how can DoD's acquisition system better exploit information to become more efficient and effective? The remainder of this paper describes an alternative approach using the principles of complexity theory.

CHAPTER 3

COMPLEXITY THEORY

The concept of information exploitation exists as an integral principle of the burgeoning scientific theory of complexity. This theory, which evolved from observations within the physical sciences (biology, physics, mathematics) has also proven applicable to the behavioral sciences.[36] This section discusses how complexity theory may relate to organizational theory and management considerations. It can therefore provide an additional source of "guidance" for the military acquisition system as part of a Third Wave civilization.

The concepts of complexity theory are not easily grasped at first reading. An attempt is made in the next few pages to explain the fundamentals as simply as possible. Be aware that a concrete example follows this explanation which will help solidify an understanding of this theory.

BASICS IN COMPLEXITY

"The science of complexity has to do with structure and order."[37] It recognizes that from the local interactions of components within a complex system, there often emerges an unpredictable global property. This property

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[36] Robert Axelrod and Douglas Dion, "The Further Evolution of Cooperation," *Science*, 9 December 1988, pp. 1385-1389.

[37] Christopher G. Langton, in Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: Macmillan Publishing Company, 1992), p. 10.

provides feedback, further influencing the behavior of the individual components. Order arises out of a complex dynamical system producing global properties which flow from the aggregate behavior of individuals. This is the principle of **emergence**. It's "order for free."[38]

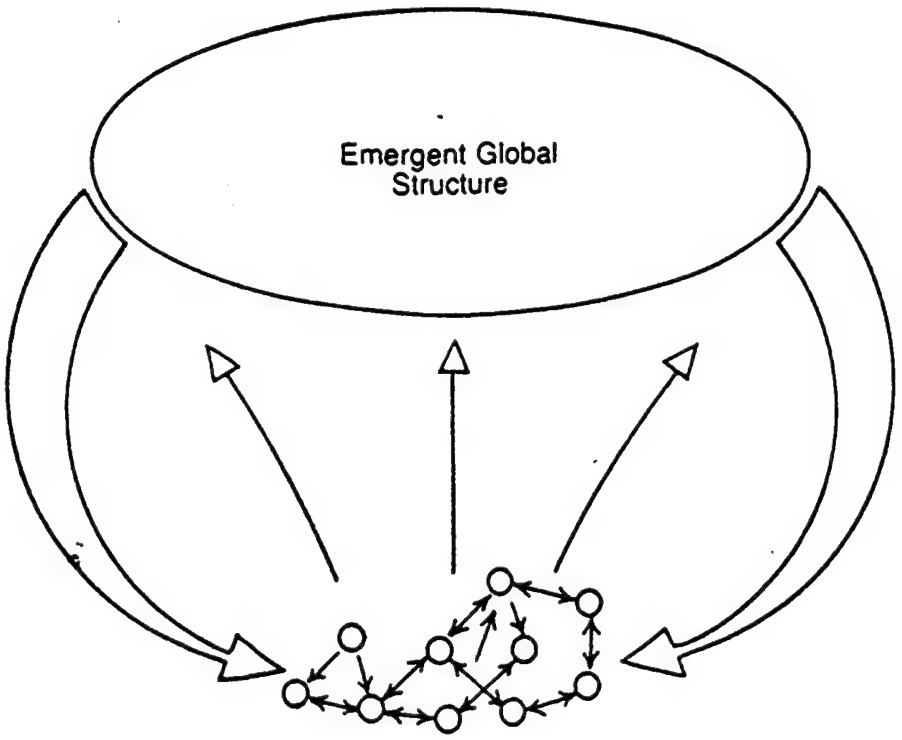

Figure 1. Emergence in Complex Systems[39]

The theory further defines these systems as complex adaptive systems. Although many systems possess complex characteristics, a complex adaptive system produces a schema, a compression of information with which it can predict the environment. In biological evolution, past experience resides in DNA while in human societies, the schemata exist as institutions, customs, traditions, and even myths. Complex adaptive systems act as pattern seekers; they interact

38 Stu Kauffman, in Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: Macmillan Publishing Company, 1992), p. 28.

39 Christopher G. Langton, in Lewin, p. 13.

with their environment, "learn" from the experience, and adapt as a result.[40] They remain in constant pursuit of a more optimal situation within a dynamic environment.

Complex adaptive systems exhibit two other evolutionary characteristics. Sometimes, a small change in the environment produces a dramatic change within the system--similar to the physics of phase transitions between solid, liquid, and gaseous states.[41] In a relatively short period of time--BANG--the system transitions to a higher level of complexity (in many cases chaos) with a different set of stable "solutions." But from this chaos, the system eventually settles at a state (or collection of states) called an attractor. It reaches that state by following the rules of the local components. Local rules thereby generate global order. "Order for Free!" This seems unpredictable and counterintuitive.

INFORMATION IS THE KEY!

Complex adaptive systems usually evolve toward an intermediate state (attractor) between chaos and stability--the "edge of chaos."

> The edge of chaos is where *information* [sic] gets its foot in the door in the physical world, where it gets the upper hand over energy. Being at the transition point between order and chaos not only buys you exquisite control--small input/big change--but it also buys you the possibility that *information processing* [sic] can become an important part of the dynamics of the system.[42]

The edge of chaos exists, therefore, at phase transitions. For example, in the physical world, cell membranes are barely poised between a solid and liquid state.[43] At this state one finds universal computation, the place in the system

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40 Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: Macmillan Publishing Company, 1992), p. 15.

41 Ibid., p. 17.

42 Ibid., p. 51.

43 Ibid.

with the maximum capacity for information processing. The membrane permits maximum information transfer, but chaos would result if it were broken. *"The ability to obtain and process information about the environment, and to react accordingly, is an important adaptation because it allows the [system components] to seek out suitable environments and resources and to avoid unsuitable ones."*[44] Complex adaptive systems gravitate toward the edge of chaos and hone the efficiency of their rules as they go.[45]

One final piece of nomenclature will help to describe the aspects of complexity theory--**fitness landscapes.** The fitness of individual components within a system depends on different combinations of characteristics which describe that component. Each point on a "landscape" represents slightly different packages of these characteristics. The fittest of the packages has the highest peak. The landscape, representing fitness possibilities, appears rugged, with peaks of different heights, separated by valleys.

In complex adaptive systems, each component compares its own fitness relative to the fitness of other system components. If interaction with another system component highlights inferior fitness, the individual component resides in a valley and it searches to scale a nearby peak.[46] Fitness landscapes are, therefore, interdependent. In a similar light, to travel from peak to peak on a fitness landscape, one has to sacrifice fitness/optimization (at least momentarily) to travel to the other side of the valley.[47]

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44 Ibid., p. 138.

45 Ibid., p. 55.

46 Ibid., p. 58.

47 Ibid., p. 126.

SUMMATION

To put it all together, adaptive agents, capable of making unpredictable, creative decisions, comprise complex adaptive systems. Simply stated, they follow two key rules of behavior:

(1) maximize mutual information (necessary and relevant);

(2) minimize local energy loss/cost (maximizing local productivity).[48]

The system therefore moves through a variety of activity states and eventually comes to rest, with fitness optimized, poised at the edge of chaos, the point of maximum capacity for information processing. It does this all through collective adaptation to selfish ends which produces maximum average fitness within the system, each agent in context with the others.[49] The system as a whole emphasizes searching for THE RIGHT JOB rather than doing the current job right.

EXAMPLE OF COMPLEXITY

A study by Lansing and Kremer very simply yet thoroughly demonstrates the key principles of complexity theory and how a complex adaptive system evolves toward an optimal solution.[50] They used the complex network of individual rice farms on the island of Bali as their system. Maximum harvest yields defined the fitness of the system and its components while water sharing and pest damage reflected opposing constraints to the optimal solution. The

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48 Telephone conversations with Commander Bill Millward, U.S. Navy, Naval War College, Newport, RI, March-May 1995.

49 Lewin, p. 59.

50 J. Stephen Lansing and James N. Kremer, "Emergent Properties of Balinese Water Temple Networks: Coadaptation on a Rugged Fitness Landscape," in Christopher G. Langton, ed., *Artificial Life III*, Proceedings Vol. XVII, Santa Fe Institute Studies in the Sciences of Complexity, (Reading, MA: Addison-Wesley, 1994), pp. 201-223.

research noted that individual farmers self-organized into cooperative units over many decades in order to balance these opposing constraints while maximizing their yields. From this evolved the highly efficient and effective water temple networks--the system's emergent property of order. A mathematical model demonstrated that this natural evolution indeed was the optimal solution for this dynamically changing system (rainfall and pests). How did this occur?

The farmers, acting as the adaptive agents, performed in accordance with the principles of a complex adaptive system. Perceiving that fields adjacent to each other directly impacted the fitness of the other, they chose to form cooperative units that coordinated cropping patterns in geographical areas. This action maximized the information flow within local fitness landscapes and minimized the average loss to all farmers in the cooperative. Recognizing further that each cooperative depended on its interaction with others in the larger water system, the entire group of island cooperatives met periodically throughout the year to synchronize cropping patterns. This further maximized mutual information within the larger system. Local conditions dictated crop patterns thereby minimizing losses and reducing costs to each cooperative. The optimal result was unpredictable and counterintuitive!

The system also displayed an interesting emergent property--the ability to recover from external perturbations (such as low rainfall or high pest levels). Although the initial impact of various perturbations caused a cascade of changes (chaos), the system eventually evolved toward a new equilibrium.[51] This highlights another feature of complex adaptive systems--enhanced ability to cope with perturbations.

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51 Ibid., p. 217.

COMPLEXITY IN MILITARY ACQUISITION

How does complexity theory relate to military acquisition? First, one must agree that DoD's system exhibits complex characteristics--innumerable and dynamic state parameters. People, acting as adaptive agents within the acquisition system, make creative and unpredictable choices to optimize the system's fitness. The cost, schedule, and performance of the system's intended product(s) represent the fitness of the system at all levels of management: at the strategic level, the cost, schedule, and performance of the aggregate system; at the operational level, the cost, schedule, and performance of the unique weapon system program; and at the tactical level, the cost, schedule, and performance of each subunit's system contribution.

As a true complex adaptive system, how it organizes itself to optimize its fitness represents only <u>one</u> emergent property of the system. This property should arise from the "selfish" actions of the components (at each level) to minimize their cost/loss affecting their own fitness. More importantly, they move toward a more optimal solution when they maximize the information processed mutually. They realize that they must act for their "selfish" ends while recognizing their interdependency on other local system components. They will eventually find fitness solutions which will move toward the edge of chaos, a state of maximum information processing, the most optimal system solution.

EXAMPLE

In more concrete terms, how teams form within an organization highlights the self-organizing principle of complex adaptive systems. The smallest unit of the system, the individual, has an assigned task as outlined in his/her job

description. In order to accomplish this task at minimal cost (cheaper, less time, better service/product), the individual recognizes the need for additional information from other individuals. Therefore, the fitness of each depends on the fitness of the other. A team is born!

In order to maximize this information flow (processing), individuals seek better ways to communicate--telephone, memos, periodic meetings, or even collocation. They observe how others improve their fitness and experiment within their own unique situation (system environment). Eventually, they discover a solution that proves more advantageous given their system constraints.

A phase transition may occur when computer networks arrive within the workplace. E-mail capability creates an additional peak on the fitness landscape. However, to get there from the current peak, one must consider the cost--training, time, inappropriate use, or information overload. Through trial, error, and/or observations of others, a better solution eventually evolves.

The situation described here has occurred informally to nearly everyone. Informal networks have existed as long as man has been a social being. When formal structures impede informal processes, groups of individuals attempt to find a higher peak on the fitness landscape. Again, through trial and error, they experiment with different solutions. Perhaps, within the formal structure of the organization, a group of individuals observes that 80 percent of their time involves constant interaction with a small group (team) of individuals from a variety of structurally unconnected work groups. They may creatively propose a structural reorganization, consolidating this team as a formally recognized unit of the organization. If the transition occurs, their fitness is evaluated by themselves as well as others. If it proves a better solution, other, interdependent teams/groups will seek a similarly higher fitness peak.

This evolutionary process correlates to any level within a system. Formal and informal interactions between program offices at the operational level may

evolve into a different process or structure. Likewise, the interactions of the different service components at the strategic level may also create a new process or structure. As long as the system and its adaptive agents continually act as in a complex adaptive system, a more optimal solution will evolve.

ACCELERATED EVOLUTION

> Many people have said that you cannot reorganize or reengineer an entity or enterprise unless it reaches the crisis stage. We in DoD are at that crisis stage. We simply cannot continue to conduct business the way we have in the past.[52]

As described above, complexity theory posits that a complex adaptive system like the DoD acquisition system will evolve to a better solution (which may not be the best)--**eventually**! Evolution, in most cases, takes too much time. The pace of change far exceeds that of the military acquisition system. The threat, the economy, and technology have all accelerated to higher levels of complexity and faster rates of change. DoD cannot wait for its acquisition system to catch up. It's already behind! How, then, can one accelerate system evolution?

CONSTRAINTS

Constraints determine a system's limits. The system must operate within those specified constraints. These constraints also characterize a system's flexibility. Logically, more/tighter constraints provide fewer solutions (a smaller landscape) while fewer/looser constraints provide more solutions. In addition, the nature of each constraint falls into one of two categories. **Positive**

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52 Colleen A. Preston, Deputy Under Secretary of Defense (Acquisition Reform), "Statement on Acquisition Reform," before the Committee on Government Reform and Oversight, U.S. House of Representatives, Washington, D.C., 21 February 1995.

constraints challenge the system toward an optimum solution or a goal. Minimum acceptable deviations in product quality drive businesses toward more market share and hopefully higher profits. Positive constraints are many times part of the definition of an optimum solution (lower cost, faster schedule). Negative constraints impede a system's progress toward a more optimal solution. For example, technological hurdles/obstacles limit weapon system performance. And yet, negative constraints should never be considered uncontrollable nor unchangeable. Rather, they can serve as opportunities for change toward a better solution.

MOVING FASTER TOWARD A MORE OPTIMAL SOLUTION

In order to accelerate the system's evolutionary process, one must first relax or remove negative constraints. This provides more possible solutions within the system. This does not ignore the fact that the optimal solution may already exist within the current system--yet to be discovered. For example, some blame closed foreign markets, federal regulations, and unions (among others) for corporate America's problems. Perhaps corporate America's own ingrained processes are the true culprit.[53]

This relaxation of negative constraints also requires that system "owners" accept additional risk. Most negative constraints arise to impart control on the system. System owners must have faith/trust in the system . . . so the system can be allowed to search for a more optimal solution. In reality, totally unconstrained systems are rare. The intention is to determine the minimum acceptable risk knowing that failures will occur.

Second, and more importantly, establish dramatic positive constraints. Challenging the system toward a more optimal goal forces creativity. In the

53 Hammer, pp. 24-25.

nomenclature of complexity theory, this action may very well push the system from a fitness peak into chaos from which it will evolve toward another fitness peak at the edge of chaos. By forcing creativity, it will drive the system toward improved information processing in search of THE RIGHT JOB!

SUMMATION

Since the DoD acquisition system is a complex adaptive system, complexity theory, therefore, provides DoD acquisition participants (adaptive agents) at all management levels, the following "guidance":

- The DoD acquisition system will eventually evolve toward a more optimal solution--a global emergent property.

- Allow the local system components to interact and evolve naturally toward a more optimal solution.

- Create a system environment which promotes this evolution:

    -- Relax negative constraints within acceptable risk;

    -- Establish dramatic positive constraints.

Armed with this brief understanding of complexity theory and its inherent guidance, one can observe in the next chapter how its principles are found in the evolution of current management and organizational approaches.

CHAPTER 4

EVOLUTIONARY THEMES

Research highlighted several evolutionary organizational and management themes that have tended to better exploit information and increase the probability of success. While presenting the characteristics and principles of each, this section will demonstrate the evolutionary nature of these themes in light of complexity theory and information exploitation.

TEAMING

Teaming, the concept of forming groups of individuals with unique contributions to a common mission, has become commonplace throughout business and the military. As briefly discussed in the previous section, this natural result arises from a desire to more optimally process information relating to a single product, process, or service. The formalization of teams, at least theoretically, breaks down some of the barriers to communication within an organization.

Integrated Product and Process Development (IPPD). IPPD, an organizational concept incorporated by many private sector businesses and a strong initiative within DoD, has proven refreshingly successful. IPPD

simultaneously integrates all essential organization activities through the use of multidisciplinary teams.[54] Integrated Product teams (IPTs) form the basic building block of the IPPD concept. Representatives from all functional disciplines necessary to deliver a particular product comprise these teams. Essentially, it's a product departmentalization of all subunits of the organization.

The concept depends on timely input from each member to make team decisions relative to the team's mission. Ideally, members include customers and suppliers, two key participants who impact product development. As an example, the following disciplines would be part of a typical IPT: program management (usually the team leader); engineering; manufacturing; test; logistics; financial management; and contracting.[55]

IPTs must also follow two key principles--cooperation and empowerment. First, individual representatives must commit fully to the team and its mission. This cooperation requires recognition of each individual's contribution of expertise and respect for each other's opinion. There must be full and open dialogue as among equals, with no secrets nor "hidden agendas." In the nomenclature of complexity theory, the team strives to maximize mutual information within the team in order to move toward a more optimal solution.

Team members must secondly be empowered. With their assumed expertise, they must contribute, perform, and decide commensurate with their position on the team. They do not represent other organizations but rather contribute their unique functional perspective for the good of the team. This "selfish" perspective, in complexity theory parlance, is weighed in comparison with other perspectives (fitness) to evolve an unpredictable, sometimes counterintuitive team emergent property.

As mentioned earlier, the structural design of this team will strongly influence its communication process and therefore its ability to exploit

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54 U.S. Department of Defense, Office of the Under Secretary for Acquisition and Technology, "The Use of Integrated Product Teams in DoD Acquisition," draft paper undated.

55 Ibid.

information. In its purest form, an IPT physically situates all members in one location, one building, one "office." This direct interface, eye-to-eye contact, establishes a near ideal communication network (obviously dependent upon the members' personalities). By executing the product's program in close proximity to each other, they directly and indirectly obtain and transfer (process) valuable information.

IPTs have limitations, though, and limited resources top the list. Some organizations have many sub products in the development of a larger product or even a wide variety of products. To assign a representative from every functional discipline to every product, organization size may double or triple. There simply is not enough manpower in the world to do this. Resource efficiency has, therefore, driven organizations to mold this concept within their unique constraints. Individuals devote shares of their time to different teams depending on organizational priorities and team needs. This may be a more efficient use of resources yet individuals are many times over committed and find themselves reducing their effectiveness to all teams.

Organizational charts, the line drawings depicting "who reports to whom," foster yet another IPT limitation. Behaviorally, an individual normally feels compelled to please the supervisor who evaluates his/her performance within the organization. Organizations also try to maintain functional career orientations so individuals are appropriately trained to represent that functional discipline. The question arises, "Should the team leader or the functional manager rate the individual's performance?" Since most organizations came from Second Wave functional structures, culture and traditions have tended to maintain a functional priority. Although workable, the team's effectiveness is sometimes reduced due to lack of total commitment to the team's needs.

In the course of research, several examples highlighted the different applications of the IPPD concept.

F-22 System Program Office (SPO). From early in its establishment, the F-22 SPO has attempted to structurally organize itself as an aggregate of IPTs. The various system components that join to make the F-22 weapon system dictate the product team groupings--fuselage, engine, and avionics as examples. In fact, this organizational concept has been employed throughout the entire program, to include the contractors' organizations. Overall, the program has found the efficiency and effectiveness of this structure more optimal than others experienced (primarily functional).[56]

However, problems do exist. Manpower limitations cannot fully address the size of this major system in a pure IPT form. Many team members shift their focus between multiple-assigned teams depending on priorities within the program.

Another problem arises due to the appraisal process. Some team members are rated by the team leader while some are rated by the functional leads. Federal civilian personnel policies constrain the appraisal system and keep functional team members tenuously tied to functional managers (a negative system constraint). Defined program processes attempt to remedy this situation.

A surprising observation is made when analyzing the SPO organization chart. Although the organization has made a concerted effort to design along IPTs, over 50 percent of the organization's teams are not aligned with a hardware product comprising the F-22 (e.g. support equipment). The "tooth-to-tail" ratio seems out of proportion. But, some of this has to do with culture--a reluctance to align along product lines. Large functional organizations still remain. Some of this is also due to unique processes within the program.

One key part of the organization structure evolved soon after IPT concept incorporation. Program management observed that the numerous sub teams

[56] Interview, Jabour.

worked well in developing their unique components of the weapon system, yet the aggregate system was less than optimal. This was a case of sub-optimization. They chose, therefore, to form an integration IPT, formed from the various component IPTs, thereby maximizing information flow across the entire system. Now, while optimizing each sub component of the system, its fitness is compared with the other sub components through this integration IPT and system level optimization is more efficiently pursued.

McDonnell-Douglas F-15 Program Office. When the Air Force SPO elected to reorganize itself using the IPT concept, its contractor counterpart at McDonnell-Douglas chose to parallel this decision in its own organization. However, after the reorganization took place, external constraints, manpower reductions, forced them to reorganize back to a matrix structure--functional divisions with formally identified product teams.[57] They therefore found the IPT concept too inefficient given its resource limitations.

Motorola Lighting, Inc. Motorola Lighting, Inc. has chosen a matrix structure based on its development cycle turnover. From a functional structure, product teams form at idea inception and disband soon after the new item reaches production.[58] This approach is ad hoc in nature due to the accelerating cycle time reductions pursued by Motorola (discussed later). The turnover in teams makes it inefficient to completely reorganize the entire company with each new product.

Advanced Medium Range Air-to-Air Missile (AMRAAM) Requirements Office. A former project officer tasked with coordinating warfighter requirements for the AMRAAM, described a complex informal network which operated much like an IPT. Simply put, with a cumbersome process to coordinate weapon system requirements among cross-functional concerns (Air Force, Navy, F-15, F-16, F-18, and more), he and others within the

57 Interview, McDonnell-Douglas.

58 Interview, Motorola.

"system" informally devised an information network which satisfied the task at hand. Although less than efficient, within the political, time, and process constraints of the system environment, it worked.[59]

From his perspective, the first action involved determining the system participants (the adaptive agents controlling the interdependent fitness landscapes). Once accomplished, he assessed who really wanted to participate and who was key to a coordinated solution (how the fitness of each system component compared to each other). A communication network arose from these "constraints" to meet the task at hand. All functions contributed to a single mission as in an IPT. This type of informal evolutionary process happens all the time in nearly every organization.

OSD and Component Staffs. In the near future, the OSD and component staff organizations will implement the IPT concept throughout the acquisition process.[60] They will participate as members of IPTs which will commit to program success. They will participate early and continuously with program office teams, to resolve issues as they arise, rather than during final decision review. (This decision derived from an Oversight and Review PAT recommendation.)

This initiative attempts to improve information exploitation throughout the program as viewed from the strategic level. It recognizes that all system components must interact to drive toward a more optimal solution. Ostensibly a move in the right direction, it must be cautioned against the same limitations other IPT organizations have experienced. First, the number of programs requiring continual participation by limited personnel on these staffs may doom

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59 Interview with personnel in Operations Group, 1st Fighter Wing, Langley AFB, VA, 13 April 1995.

60 U.S. Department of Defense, Office of the Secretary, "Use of Integrated Product and Process Development and Integrated Product Teams in DoD Acquisition," draft memorandum undated.

the effectiveness of this concept.[61] Continual, however, does not mean constant. The right level of participation will evolve or the concept will fail.

Finally, the mandate by Secretary Perry to implement IPTs at the strategic level must not be construed as a mandate at other levels of management within the system. Although many organizations have already incorporated this concept, interaction at the various levels must be allowed to evolve, to self-organize as they deem appropriate for their unique situations. As was observed earlier, no single ideal structure (or concept) will work for all organizations.

PROCESS ORIENTATION

Michael Hammer and James Champy, in their popular book, *Reengineering the Corporation: A Manifesto for Business Revolution*, propose that system processes hold the key to success. They define reengineering as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed." [authors' emphasis][62] Processes, "...a collection of activities that takes one or more kinds of input and creates an output...,"[63] are the basic structure of information exploitation within an organization. Once recognizing that process reigns supreme, businesses start over with a blank sheet of paper and redesign their processes and structures from the ground up.

Note that this concept employs a form of process departmentalization. The key distinction, though, is that many organizations have fragmented their processes. Reengineering attempts to eliminate that fragmentation and conjoin

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61 Interview with Professor Charles B. Cochrane, Acquisition Policy Department, Defense Systems Management College, Fort Belvoir, VA, 12 April 1995.

62 Hammer, p. 32.

63 Ibid., p. 35.

associated processes into efficient operations. In addition, no single "structural solution" works for all organizations. The concept revolves around processes and structures become a by-product.

IBM Credit Corporation reduced its response time to a customer's financing request by 90 percent while improving productivity 100 times. By examining its process and assessing how information was exploited, they recognized common characteristics within the process. Moving from a serial process of specialists to a one-step process of a generalist, they produced radical change toward optimization.[64]

Kodak, through the innovative use of Computer Aided Design/Computer Aided Manufacturing (CAD/CAM), incorporated concurrent engineering within its product development process. Technology, a phase transition, elevated the system to a higher level of complexity, allowing a constant flow of information between design and manufacturing functional organizations. The result was a 50 percent reduction in product cycle time.[65]

Along with a process orientation, reengineering includes several other themes which can be observed as relating to the evolution of complex adaptive systems. As seen in the Kodak example, creative use of information technology allowed a phase transition within the system to move the system's fitness to a higher peak. No doubt the transition created some chaos in the process but the result, a continual sharing of mutual information minimized the cost (primarily in time) to both the design and manufacturing organizations.

Hammer and Champy emphasize that information technology acts as an essential enabler without which reengineering will not occur.[66] "The real power of technology is not that it can make the old processes work better, but that it enables organizations to break old rules and create new ways of working."[67]

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64 Ibid., pp. 36-39.

65 Ibid., pp. 45-46.

66 Ibid., p. 44.

67 Ibid., p. 90.

Put another way, organizations need to search for the uses of technology that allow it to do things it's not already doing.[68] The maturing technology of expert information systems, computer systems which make their own, learned decisions, may be one of these opportunities just on the horizon.

Reengineering also explores rule breaking. Organizations must reexamine the constraints within the system and determine which ones would provide dramatic optimization if eliminated. Unwritten traditions and assumptions restricting the system present tremendous opportunities for positive change, as do the formalized obstacles embodied in rules and regulations. Identifying these negative constraints is the first necessary step to removing them.

Reengineering requires one last characteristic--ambition. THINK BIG. Dramatic improvements result from significant and meaningful goals. "The temptation to take the easy path and to settle for the marginal improvement is great. In the long run, however, marginal improvement is no improvement at all, but a detriment."[69] Therefore, positive constraints which aim the organization well beyond its current performance are critical to a reengineering effort.

The following summarizes the kinds of changes an organization would experience during reengineering:

- Work units change from functional departments to process teams--information processing becomes a part of the structure.

- Jobs change from simple tasks to multi-dimensional work--specialist to generalist--each worker/work unit moves toward the edge of chaos, the place of maximum information exploitation.

- Individuals' roles change from controlled to empowered (no room for intrusive supervisors)--the system components are permitted to act and interact to allow an unpredictable system property to emerge.

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68 Ibid., p. 85.

69 Ibid., p. 205.

- Job preparation changes from training (how) to education (why)--promotes recognition of the interdependency of system component fitness peaks and doesn't dictate/mandate a given system solution.

- Performance measures and compensation shift focus from activity to results--"selfish" yet interdependent fitness peaks.

- Values change from protective to productive--find the Right Job.

- Managers change from supervisors to coaches--creating the appropriate system environment to enhance creativity.

- Organizational structures change from hierarchical to flat (coach 30 versus supervise 7)--eliminates unneeded information processing and enhances the speed of information transfer.

- Executives change from scorekeeper to leader--while creating the appropriate system environment they promote system interaction toward positive goals.[70]

"Fundamentally, reengineering is about reversing the industrial revolution [Second Wave] . . . Reengineering is the search for new models of organizing work. Tradition counts for nothing. Reengineering is a new beginning."[71]

SYSTEM THINKING

Peter Senge, in his book, *The Fifth Discipline*, describes the concept of the learning organization, "an organization that is continually expanding its capacity to create its future."[72] This concept, like reengineering relates to complexity theory and how organizations can evolve toward more optimal organizational performance. The key to a learning organization resides in the

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70 Hammer, pp. 65-79.

71 Ibid., p. 49.

72 Senge, p. 14.

approach of system thinking, the fifth discipline.

> "I call systems thinking the fifth discipline because it is the conceptual cornerstone that underlies all of the five learning disciplines . . . All are concerned with a shift of mind from seeing parts to seeing wholes, from seeing people as helpless reactors to seeing them as active participants in shaping their realities, from reacting to the present to creating the future. Without systems thinking, there is neither the incentive nor the means to integrate the learning disciplines once they have come into practice. As the fifth discipline, systems thinking is the cornerstone of how learning organizations think about their world.[73]

In essence, the foremost discipline of a learning organization, system thinking, entails a shift of mind. It requires a perspective of interrelationships rather than linear cause-effect chains. It views the system as changing processes rather than snapshots in time.[74] Applied to a complex adaptive system, it focuses on how the system exploits information throughout its processes and local interactions. Systems thinking, a holistic discipline, considers the BIG PICTURE while the other four disciplines form the system environment.

Personal mastery is the discipline of personal growth and learning. It applies to individual people and organizations within the system. Those that possess it continually search for ways to expand their capabilities (fitness) while reaching for higher goals (positive constraints). This "selfish" perspective provides the foundational spirit of the learning organization.[75]

The discipline of ***mental models*** embodies a conscious effort to expose hidden assumptions and challenges molded mind sets. It demands a examination of system constraints which limit the system's progress toward optimization.[76] As in reengineering, it assesses the impact of these negative constraints and determines which would benefit the system, cost effectively, if relaxed or eliminated. It seeks to redefine the conscious or subconscious system definition.

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73 Ibid., p. 69.

74 Ibid., p. 73.

75 Ibid., p. 141.

76 Ibid., pp. 174-204.

The discipline of ***shared vision*** "provides the focus and energy for learning. While adaptive learning is possible without vision, generative learning occurs only when people are striving to accomplish something that matters deeply to them..."[77] Shared vision becomes the system's internalized goal toward better system performance. This positive system constraint drives interaction and the exploitation of information to a higher level of complexity through creativity. Shared vision provides the guide toward the edge of chaos.

The discipline of ***team learning*** "is the process of aligning and developing the capacity of a team to create the results its members truly desire."[78] It recognizes that the fitness of the organization or the system depends on the interdependencies of its components' fitness landscapes. Teams, "... 'people [adaptive agents] who need one another to act'. . . are becoming the key learning units in organizations."[79]

An organization emerges as a learning organization if it embraces these five key disciplines. This learning property continually drives the organization toward a more optimal solution. And it accomplishes this through the selfish and interactive exploitation of information by its adaptive agents.

STRATEGIC PLANNING

Planning for the future is nothing new in organizations. Every one does it to some limited degree. But some organizations construct strategic plans to change the system toward a higher level of complexity, toward a better solution. They accomplish this by first establishing dramatic, "stretch" goals[80] (positive

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77 Ibid., p. 206.

78 Ibid., p. 236.

79 Ibid.

80 "Reengineering the Acquisition Oversight and Review Process," final report of the Acquisition Reform Process Action Team, Office of the Deputy Under Secretary of Defense (Acquisition Reform), Washington, D.C., 9 December 1994.

system constraints) and then exploring the roadmap on the way to that goal.

They first assess their current position on the map--their baseline performance (fitness) and compare it with other organizations. The one closest to the established goal becomes the system's benchmark--the best achievable and proven performance to date.

On the roadmap, the organization draws a straight line from its current position to the "stretch goal." The length of the line is analogous to cost (including time). Therefore, the shortest line to the goal (a straight line) defines the cheapest route of travel. Unfortunately, this line crosses points on the map where there are no roads, or passes over unscalable mountains or uncrossable rivers. These negative constraints on the map can sometimes be overcome by detours, all at some cost. For instance, a resource limitation might be mitigated by use of another material. Better yet, its need might be eliminated totally. Process obstacles, on the other hand, may be reengineered.

Some obstacles, however, are more formidable than others. Crossing a river that spans the width of the map (and no bridge is available) creates a veritable brick wall to the plan. This may be analogous to a technological system limitation (e.g. the speed of sound in aircraft design earlier this century). If truly committed to achieving that goal, the organization explores alternatives to resolve the problem. Not knowing the ultimate cost of success of any potential resolution, it may invest in three plans to cross the river: build a bridge (army); construct a boat (navy); or build an airplane (air force). Each costs a certain amount and must address various problems: the river is 20 miles wide; treacherous rapids stretch its breadth; and cargo weight exceeds any available aircraft design technology by 50 percent. The goal might be realizable but the solution is not in hand. Alternatives must be pursued and weighed relative to cost.

Figure 2 depicts graphically an organization's roadmap to a chosen goal. A resource swamp and a process road cause them to deviate from the "best" solution (a straight line), but they can surely progress forward. A regulation mountain and a technology river prevent sure attainment of the goal at any cost. Alternative plans focus perhaps on lobbying against the regulation or requesting a waiver. Pursuit of three alternative technology programs may overcome the technology river.

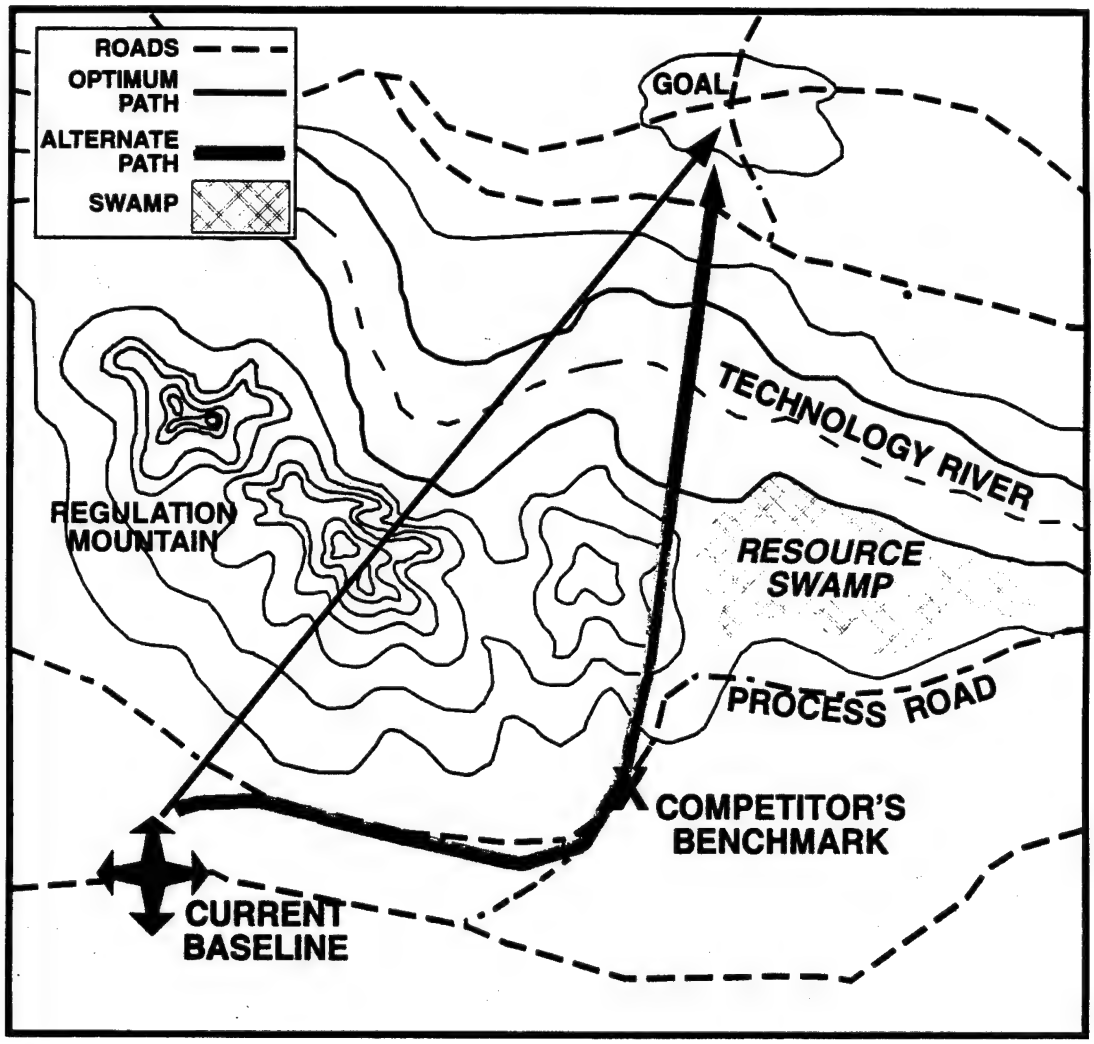

Figure 2. Roadmap to "Stretch Goals"

The strategic plan, in this context, defines the system route of travel toward a dramatic, "stretch" goal. How the organization progresses toward that goal is up to the determination of its component parts, the interactive, adaptive agents, sharing information, and selfishly reducing their own cost. Creativity will arise to overcome the obstacles--a new order emerges! If nothing else, any movement closer to the goal produces a better solution than the current situation.

THIRD WAVE CHAMPION

Although there are many champions of the Third Wave civilization--those who have uniquely exploited information and achieved unpredictable success--this brief section will describe the efforts of one of those--Motorola Lighting, Inc. The outgrowth of a new product venture, this company has produced electronic lighting products, such as fluorescent light ballasts, since 1991. The Motorola Corporation as a whole, winner of the Baldridge Award for product and organizational quality, has an enviable reputation in the private sector. Their accelerating growth is a by product of this earned reputation and a concerted strategic corporate vision. Motorola Lighting, a microcosm of the larger corporation (system), demonstrates how they have achieved such success.

In the mid '80s, Motorola management established a corporate initiative that aims at product performance--SIX SIGMA QUALITY. Briefly stated, this positive constraint intends to create a manufacturing process with a minimum of defects--on the order of 3.4 per 1,000,000 manufactured items. At the time, personnel within the company considered this goal ludicrous, beyond possibility. So did many in the business community. And yet, the corporation committed itself to the goal and forged ahead. Results have been phenomenal! Motorola quality

has become the benchmark in many parts of the industry. Even though the goal has not been achieved in every case, the significant movement toward a better product has outpaced many of its competitors.

This corporate initiative remains a hallmark of their business processes today. It serves as a dramatic positive constraint, fueling unpredictable creativity within the company. Personnel recognize in many cases that performing their assigned job, even to perfection, will not help attain the established goal. They therefore doggedly seek out the right job, one which moves closer to that goal.

At Motorola Lighting, cross-functional product teams form with the inception of a new product idea. Within the team, they maximize the information relevant to interdependent disciplines while "selfishly" minimizing each discipline's "cost" to the product. This system level thinking goes on to identify the obstacles impeding progress toward the goal and subsequently takes action to mitigate them. From the continual flow of information within the team, focused on a product, and manufactured with lofty quality goals, there emerges a system with heretofore unpredictable characteristics.

At the same time, intensive planning occurs at the company's strategic and operational management levels. A relatively flat organization, the company's cross-functional managers examine process and product relationships as part of its long range plan. They determine which negative constraints impede progress toward their goal(s). For instance, they may explore the potential of some developing technologies to eliminate a formidable constraint. They may invest in three of those endeavors with the hope that one achieves a breakthrough. All the while, they continually revisit their long range plan to determine its appropriateness within the dynamically changing system.

The SIX SIGMA QUALITY initiative has given rise to another--10X CYCLE TIME REDUCTION. In less than five years, they intend to reduce TEN TIMES the time it takes to field a new product (from idea inception to customer delivery).

What used to take two years to produce will reach the customer in less than three months. Creatively searching for the right job to achieve the constraint has already yielded a reduction of four times the baseline measurement. In the meantime, quality remains paramount as the company accelerates its growth.

Motorola has pursued a philosophy consistent with complexity theory. It recognizes that its business systems (companies) can evolve toward better solutions. It permits (even encourages) each company, like Motorola Lighting, to constantly search for better ways of doing business. They likewise create an environment which stimulates creativity through increased information sharing by establishing dramatic positive system constraints--corporate initiatives. The results speak for themselves!

CHAPTER 5

TOWARD THE FUTURE

The prognosis for DoD's acquisition system does not appear as bleak as one might perceive at first impression. In the course of research for this paper, it became apparent that a great deal of activity has already focused on improving the system, with the steamroller gaining even more momentum daily. Perhaps it is caught up in the wake of the private sector's forward movement or maybe, as was mentioned earlier, it has reached the crisis stage. For whatever reason, change is evident and generally with a positive result.

The Office of the Deputy Under Secretary of Defense for Acquisition Reform, led by Mrs. Colleen Preston, spearheads DoD's efforts. In light of the discussion in this paper, they have concentrated their activity in relaxing or eliminating the unending myriad of negative constraints that limit DoD's acquisition system. By utilizing a Process Action Team (PAT) approach, a temporary, cross-functional forum of knowledgeable and accountable system participants, they have identified the key obstacles within the system and have attempted to reconstruct these limitations for positive system ends. Examples include: the Federal Acquisition Streamlining Act of 1994 (FASTA 94); the Specifications and Standards PAT; the Oversight and Review Process PAT; the Contract Administration PAT; and the Procurement Process PAT. Many of these resulted from increased information flow throughout the system (PATs), both

vertically (DoD acquisition only) and horizontally (contractor to warfighter). Some feel, however, they have not done enough nor have they made much headway. Realizing that their mission is monstrous and foreboding, any movement forward portends improvement.

These actions at the strategic level have been complemented by reform initiatives at the operational level. Organizations throughout the military acquisition system are searching, experimenting, and observing, all as an evolutionary process toward a more optimal way of doing business. The incorporation of the Integrated Product Team concept at the F-22 System Program Office and the F-15 program's creation of a disciplined network of information--EAGLE NET--exist as prime examples. And yet, the system has so much inertia. Although it has improved, it has a tremendous amount of ground to catch up. So what's the answer?

ROADMAP TO OPTIMIZATION

In light of complexity theory and supported by numerous examples in private sector business, this research proposes the following guidance:

- Recognize that DoD's acquisition system will self-organize toward a better organizational solution at each level of management.

- Create an acquisition system environment which promotes and accelerates this evolutionary process toward optimization.

  -- Eliminate or relax negative system constraints within acceptable risk.

  -- Establish dramatic positive constraints which will stimulate creativity through increased information processing.

Don't mandate change; allow the system to find the better solution from within. IPTs may be a natural evolution in management (so were functional/stovepipe organizations in the Second Wave civilization), but they may not be the optimum for such a dynamically changing system. Better yet, they may be the best today but not tomorrow.

The answer/solution will evolve through better communication--information exploitation. Information exists within an organization and without. Fitness landscapes depend on those around them. Sharing of information for selfish ends is good for all (WIN-WIN).

The constraints on the system are key to the evolutionary process. The relaxation of negative constraints, an action counter to the historical trend in acquisition, expands the number of possible system solutions. But first and foremost, DoD must establish dramatic positive constraints or goals. Business as usual must not be capable of achieving these goals. This action alone will demand creativity, arising from the massive processing of information within the system and with other systems. The how remains to be discovered or realized. But give the system a push!

What are possible positive constraints? As Motorola and others have demonstrated, significant strides toward improvement require significant goals. If cost, schedule, and performance determine the measure of optimization (fitness) for the DoD acquisition system, then goals associated with these parameters will ensure a positive movement forward. The following are possible examples of "stretch goals" to which DoD acquisition management must choose to commit.

Cost. **In ten years, reduce government acquisition-related operating costs by 50 percent.** This should be accomplished without sacrificing product/service performance or quality. This does not mean the cost of weapon systems (although that is indirectly impacted). Rather, it aims at what

the government pays itself to operate an acquisition system. This will definitely affect how we do business and how we organize ourselves accordingly.

Schedule. Reduce acquisition cycle time 50 percent within the next ten years. Again, maintaining other parameters constant or better, this addresses the time from concept inception to fielding throughout the life cycle of the product. This includes major weapon systems as well as small item supplies. Remember, no single answer will solve all questions/problems.

Performance. Increase reliability of all products by 100 percent within ten years. This includes old, already-fielded products as well as new ones. Obviously, the warfighter and contractor become strongly involved in the attainment of this goal.

These may sound impossible, yet any movement forward toward them will be nothing but positive for the overall system. They cannot be accomplished overnight. But they are realizable. To get there, each level of management and execution must examine its processes and determine a strategic roadmap toward them. Innovation will become the watchword. Obstacles must be identified and attacked--in concert with other system components. Many will retort, "Haven't we taken enough hits in recent years?" Granted, the pain has been unnerving but the DoD acquisition system is still stuck in the mud trying to do the job right. The time is ripe for it to discover THE RIGHT JOB!

Realize also that this proposed guidance and associated "stretch goals" apply throughout the entire DoD acquisition system, not just at the strategic level. At the operational level, for instance, the System Program Director must recognize that his/her program will evolve toward a better system. He/she can accelerate that evolution by creating an environment which stimulates information sharing within the program and with other programs and agencies. Set program goals commensurate with the strategic "stretch goals" previously mentioned. Read about, observe, and discuss how other, similar organizations

achieve successes (some mentioned in this paper). Search out and exploit information mutually beneficial to "adjacent" organizations (other program offices, contractors, warfighters, materiel commands, etc.) and component work units within the organization.

The same holds true for each individual and small unit within the DoD acquisition system. Constantly explore better ways of doing business, search for the RIGHT JOB, by sharing mutually beneficial information with other work partners and teams. Examine what is tasked, why it is required, and how it is accomplished. Forge creativity by stretching toward significant personal and team goals. Above all else, remember that information exploitation is the key!

INCENTIVES

One problem remains unsolved. Establishing a goal does not move a system closer to it. Adaptive agents require incentives toward goal realization--toward information exploitation--toward creativity! It's relatively easy to incentivize defense contractors in attainment of their goals--PROFIT. Make it worth their while to reduce their operating costs, reduce their cycle times, and improve their product reliability. Profit is their reason for existence and they'll do anything to earn more of it.

But what about the government? What motivates people inside DoD? Survival is paramount to warfighters! They perform to survive in combat. The DoD acquisition community, however, lacks the strong motivation as is found in other endeavors. Surely, some are motivated by promotion, esprit de corps (morale), and even competition from the threat (although this has become ill-defined lately). Incentives in acquisition are not as hard-hitting as profit or survival.

This paper does not address incentives. Likewise, no solution appeared promising while in the course of research. It is highly recommended that future research efforts tackle this issue, a complementary and necessary key to success.

CONCLUSION

Within the broad context of acquisition reform, this paper evaluated a variety of organizational and management alternatives in light of the underlying principle of a Third Wave civilization--information exploitation. Although the military acquisition system has produced the world's premier weapon system inventory, its cost, schedule, and technological inefficiencies jeopardize future U.S. military superiority.

No single, ideal organizational structure was found which can improve the exploitation of information within the military acquisition system. Rather, organizational structure was logically observed to depend upon a unique combination of system and organization characteristics: product, process, timing, resources, culture, geography, and personality. Most important, though, an organization's process outweighs the impact of any other characteristic.

The relatively new science/theory of complexity shows surprising applicability to evolutionary organizational and management trends. A complex adaptive system, like DoD acquisition, naturally evolves toward the "edge of chaos," the point of maximum capacity for information processing, if each system follows two prime rules:

(1) maximize mutual information (necessary and relevant);

(2) minimize local energy loss/cost (maximizing local productivity).

It does this through collective adaptation toward selfish ends which produces

maximum average productivity, each participant in context with the others. The system as a whole emphasizes searching for THE RIGHT JOB rather than doing the current job right.

Several current organizational and management themes have tended to better exploit information and increase the probability of success. They include teaming, process orientation, system thinking, and strategic planning. Each demonstrates evolutionary characteristics in light of complexity theory and exists as a possible alternative toward better organization and management solutions.

Based on complexity theory and supported by numerous examples in private sector business, this paper posits that DoD's acquisition system will self-organize toward a better solution if allowed to evolve. This process should be accelerated by relaxing negative constraints within the system while establishing dramatic positive constraints or "stretch goals." The mitigation of negative constraints, an action counter to the historical trend in acquisition, will expand the number of possible system solutions, while positive constraints will demand creativity, arising from a massive processing of information within the system and with other systems.

The DoD acquisition system must fully transition itself into the Third Wave civilization. With information exploitation as the key, the principles of complexity theory describe the door through which the system should pass. Organizational structure, albeit a factor, is not the answer. Rather, all acquisition participants--OSD, warfighter, contractor, service staffs, and the DoD acquisition community--must create an appropriate system environment which stimulates the accelerated evolution of a better way of doing business. Through the maximum sharing of mutually beneficial information and the "selfish" maximization of local productivity, A BETTER SYSTEM WILL EMERGE! And "stretch goals" will provide the strongest impetus toward that CREATIVITY and ACTION. Now is the time for the DoD acquisition system to FIND THE RIGHT JOB!

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